CLAIMS

What is claimed is:

1. A method for tooth rejuvenation comprising:

applying to a tooth a layer of a composition comprising an aqueous solution of one or more edible acids, wherein the composition has a pH selected from the range of about 0.5 to 5 and wherein the composition does not contain peroxide; and

removing the composition from the tooth.

2. The method of Claim 1, wherein the pH is selected from the range of about 0.5 to about 3.

3. The method of Claim 1, wherein the pH is selected from the range of about 1 to 1.75.

4. The method of Claim 1, wherein one or more edible acids is one or more carboxylic acids.

5. The method of Claim 1, wherein one or more edible acids is selected from the group consisting of acetic acid, citric acid, tartaric acid, lactic acid, fumaric acid, malic acid, maleic acid, ascorbic acid, adipic acid, and sorbic acid and combinations thereof.

6. The method of Claim 1, wherein applying the layer of the composition lasts between 1 second and 60 minutes at a body temperature at the tooth surface.

7. The method of Claim 1, wherein applying the layer of the composition occurs at temperatures between 40°C and 60^{0}C.

8. The method of Claim 1, wherein the composition further comprises a light absorbing material.

9. A method for tooth rejuvenation comprising:

applying to a tooth surface a layer of composition comprising an aqueous solution of one or more edible acids and ions comprising the elements selected from the group consisting of Ca, Cr, Ba, Cd, Mg, P, As, Si, F and combinations thereof, wherein the composition has a pH selected from the range of about 0.5 to 5; and

removing the composition from the tooth surface.

10. The method of Claim 9, wherein the pH is selected from the range of about 0.5 to 3.0.

11. The method of Claim 9, wherein one or more edible acids comprises one or more carboxylic acids.

12. The method of Claim 9, wherein one or more edible acids is selected from the group consisting of acetic acid, citric acid, tartaric acid, lactic acid, fumaric acid, malic acid, maleic acid, ascorbic acid, adipic acid, sorbic acid and combinations thereof.

13. The method of Claim 9, wherein applying the layer of the composition lasts between 1 second and 60 minutes at a body temperature at the tooth surface.

14. The method of Claim 9, wherein applying the layer of the composition occurs at temperatures between 40^0C and 60^0C.

15. The method of Claim 9, wherein the composition further comprises a light absorbing material.

16. The method of claim 9, wherein the composition comprises peroxide in of concentration up to 35%.

17. A method for tooth rejuvenation comprising:

applying to a tooth surface a layer of composition comprising an aqueous solution of one or more edible acids, wherein the composition has a pH selected from the range of about 0.5 to 5;

heating the composition to a temperature no higher than 60^0C; and

removing the composition from the tooth surface.

18. The method of Claim 17, wherein heating the composition comprises acting on a composition with a pulsed heating source.

19. The method of Claim 17, wherein a pulse of the heating source has a width shorter than 1 second and a duty cycle lower that 0.4.

20. The method of Claim 17, further comprising applying a remineralization compound to the tooth surface.

21. The method of Claim 9, further comprising applying a remineralization compound to the tooth surface.

22. The method of Claim 1, further comprising applying a remineralization compound to the tooth surface.

23. The method of Claim 17, wherein one or more edible acids comprises one or more carboxylic acids.

24. The method of Claim 17, wherein one or more edible acids is selected from the group consisting of acetic acid, citric acid, tartaric acid, lactic acid, fumaric acid, malic acid, maleic acid, ascorbic acid, adipic acid, sorbic acid and combinations thereof.

25. The method according to Claim 20, wherein the step of applying the composition and the step of applying the remineralization compound alternate.

26. The method according to Claim 21, wherein the step of applying the composition and the step of applying the remineralization compound alternate.

27. A tooth rejuvenating composition comprising an aqueous solution of one or more edible acids having a pH within the range from about 0.5 to about 5, which composition does not contain peroxide.

28. The tooth rejuvenating composition of Claim 27 further comprising the elements selected from the group consisting of Ca, Cr, Ba, Cd, Mg, P, As, Si, F and combinations thereof in a chelating agent.

29. The tooth rejuvenating composition of Claim 28, wherein the Ca chelating agent is selected from the group consisting of ethylenediaminetetraacetic acid and its salts.

30. The tooth rejuvenating composition of Claim 27, wherein the edible acid is a polycarboxylic acid.

31. The tooth rejuvenating composition of Claim 27, further comprising at least one light absorbing ingredient having a coefficient of absorption higher than that of a tissue surrounding the tooth in a range of wavelengths.

32. A tooth rejuvenating article of manufacture comprising a porous material and an aqueous solution of one or more edible acids having a pH within the range from about 0.5 to about 5, and wherein the composition does not contain peroxide.

33. The tooth rejuvenating article of manufacture of Claim 32, wherein the pH is selected from the range of about 0.5 to 3.

34. The tooth rejuvenating article of manufacture of Claim 32, wherein one or more edible acids comprises one or more carboxylic acids.

35. The tooth rejuvenating article of manufacture of Claim 32, wherein one or more edible acids is selected from the groups consisting of acetic acid, citric acid, tartaric acid, lactic acid, fumaric acid, malic acid, maleic acid, ascorbic acid, adipic acid, sorbic acid and combinations thereof.

36. The tooth rejuvenating article of manufacture of Claim 32, wherein the composition further comprises a light absorbing material having a coefficient of absorption higher than that of a tissue surrounding the tooth in a range of wavelengths.

37. The tooth rejuvenating article of manufacture of Claim 32, further comprising a comprising Ca, Cr, Ba, Cd, Mg, P, As, Si, and F in a chelating agent.

38. A capsule comprising a composition with an aqueous solution of one or more edible acids having a pH from within a range from about 0.5 to about 5, the composition not containing peroxide.

39. An applicator for rejuvenating treatment comprising:

a housing with a capsule comprising a composition with an aqueous solution of one or more edible acids having a pH from within a range from about 0.5 to about 5, the composition not containing peroxide; and

a delivery system coupled to the capsule, the delivery system selected from at least one of a brush, a porous tip and an injector.

40. The applicator of Claim 39, further comprising a heating element serving to raise a temperature of the composition to a desired temperature.

41. The applicator of Claim 39, wherein the pH is selected from the range of about 1 to about 1.75.

42. The applicator of Claim 39, wherein the capsule is detachable from the applicator.

43. A apparatus for rejuvenating hard tissue, comprising:

a housing with a capsule comprising an aqueous edible acid composition,

a heating element for heating the acid composition;

a temperature sensor for monitoring the temperature of the acid composition;

a control system connected to the heating element and the temperature sensor to maintain the temperature of the acid rejuvenation composition at a desired temperature, the control system also serving to activate an indicator when the desired temperature is achieved;

a power supply for providing power to the heating element upon activating a switch; and

an applicator for applying the acid composition onto external surface of hard tissue.

44. The apparatus of claim 43, further providing a light source for illuminating hard tissue, and a switch to activate the light source.

45. An apparatus for rejuvenating teeth, comprising:

a light source for illuminating and heating teeth, the light source being connected to a control power block and serving to generate light in a range of wavelengths in which a

coefficient of absorption of a composition comprising an aqueous solution of one or more edible acids and having a pH from within a range from about 0.5 to about 5 is higher than that of a tissue surrounding teeth; and

a detachable mouthpiece coupled to the light source.

46. The apparatus of Claim 45, further comprising a temperature sensor for detecting the temperature of teeth, the temperature sensor being coupled to the control power block.

47. The apparatus of Claim 45, wherein the range of wavelengths is in the range from 600 nm to 1350 nm.

48. The apparatus of Claim 45, further comprising an optical system optically coupled to the light sources and guiding the light from the light source to the teeth.

49. An apparatus comprising:

a first portion spaced apart from a second portion, the first and the second portions disposed in the hand-held apparatus, the first portion serving to contain an acid-based tooth rejuvenation composition and the second portion serving to contain a second composition when the apparatus is in operation;

a chamber connected to the first and the second portions; and

a mechanism for propelling the acid-based tooth rejuvenation composition and the second composition into the chamber.

50. The apparatus of Claim 49, further comprising an applicator coupled to the chamber.

51. The apparatus of Claim 50, wherein the applicator is a head of a toothbrush or a floss.

52. The apparatus of Claim 49, wherein the mechanism for propelling comprises a first pump operating on the first portion and a second pump operating on the second portion.

53. A method of hard tissue modification comprising:

impregnating a porous layer of the tooth with particles;

impregnating the porous layer with a compound capable of polymerizing when exposed to light; and

exposing the compound to light to induce polymerization.

54. The method of Claim 53, further comprising forming the porous layer mechanically or chemically.

55. The method of Claim 53, wherein the porous layer has a thickness of about 0.5-100 microns.

56. An apparatus for selective heating of a hard tissue surface comprising:

a main unit comprising one or more sources of heating energy, a cooling unit and a control unit; and

a handpiece flexibly coupled to the main unit by a flexible connection, the handpiece comprising a tip serving to transmit the heating energy capable of heating a surface layer of a hard tissue between 100^0C and 2000^0C.

57. The apparatus of Claim 56, further comprising a sensor incorporated into the tip to control heating or cooling of the surface layer.

58. The apparatus of Claim 56, wherein the heating energy is acoustic, electromagnetic, comprising light, microwave, radio frequency, and electric current, and combinations thereof.

59. The apparatus of Claim 56, wherein the flexible connection is a tube comprising one or more waveguides.

60. The apparatus of Claim 57, wherein the sensor is mechanical, electrical, optical or acoustical.

61. The apparatus of Claim 58, wherein the heating energy is a pulsing laser with a wavelength within a range from 0.15 micron to 0.4 micron and from 1.85 microns to 11 microns.

62. A method of hard tissue modification comprising selectively heating a porous layer of the hard tissue to cause the porous layer to fuse.

63. The method of Claim 62, wherein selectively heating comprises acting on the porous layer with a pulsed laser.

64. The method of Claim 62, wherein a thickness of the porous layer is between 0.5 μm and 100 μm.

65. The method of Claim 62, wherein selectively heating comprises heating the porous layer to a temperature higher than a melting temperature of hard tissue but less than 2000^0C.

66. The method of Claim 62, further comprising forming the porous layer of the hard tissue before selectively heating the porous layer.

67. The method of Claim 62, further comprising cooling the porous layer with a cooling fluid.

68. A method of hard tissue rejuvenation comprising:

impregnating a porous layer of the hard tissue with particles, the particles having a fluidity temperature lower than a melting temperature of the porous layer of a hard tissue;

selectively heating the porous layer to a temperature lower than that the melting temperature of the porous layer of the hard tissue, but higher than the fluidity temperature of the particles, therefore liquefying the material of the particles; and

letting the material of the particles to solidify.

69. The method of Claim 67, wherein the particles are organic particles.

70. The method of Claim 69, wherein the organic particles are made of polymethylmethacrylate, polycarbide or epoxy.

71. The method of Claim 68, wherein the particles are inorganic particles.

72. The method of Claim 71, wherein the inorganic particles are selected from the group comprising fluoride, germinate, phosphate, lanthanum, zirconium, and silica glasses, and combinations thereof.

73. The method ot Claim 71, wherein the particles are crystals selected from the group containing of $Ca(NO_3)_2$, $Ca(OH)_2$, BaO_2, $CdCl_2$.

74. The method of Claim 68, wherein selectively heating the porous layer comprises heating by acoustic energy, electromagnetic energy, comprising light, microwave, radio frequency, and electric current, and combinations thereof.

75. A method of hard tissue modification comprising:

impregnating a porous layer of the hard tissue with particles having a fluidity temperature about the same as a melting temperature of the hard tissue of the porous layer; and

selectively heating the porous layer to a temperature higher than the melting temperature of the hard tissue, causing the hard tissue and the particles to fuse.

76. The method of Claim 75, wherein the particles are inorganic particles.

77. The method of Claim 76, wherein the inorganic particles are crystal , ceramic, glass or their mixture.

78. The method of Claim 76, wherein the inorganic particles are name OfNa_2O-Al_2O_3-SiO_2, $Ca(PO_3)$, CaF_2, Caio$(P0_4)_6(OH)_2$, and $Ca_{10}(PO_4)_6F_2$.

79. The method of Claim 75, wherein selectively heating the porous layer comprises heating by acoustic energy, electromagnetic energy, comprising light, microwave, radio frequency, and electric current, and combinations thereof.

80. A method of hard tissue modification comprising:

impregnating the porous layer of hard tissue with particles having a fluidity temperature higher than a melting temperature of a hard tissue of the porous layer; and

selectively heating the porous layer to a temperature higher than the melting temperature of the hard tissues, but lower than the fluidity temperature of the particles.

81. The method of Claim 80, wherein selectively heating the porous layer comprises heating by acoustic energy, electromagnetic energy, comprising light, microwave, radio frequency, and electric current, and combinations thereof.

82. The method of Claim 80, wherein the particles are inorganic particles.

83. The method of Claim 82, wherein the inorganic particles are made of crystal, ceramic, glass or their mixture.

84. The method of Claim 83, wherein the particles are made of quartz glass or sitall glass.

85. The method of Claim 83, wherein the particles are crystals selected from the group consisting of crystals of quartz, diamond, sapphire, topaz, amethyst, zircon, agate, granite, spinel, fianite, tanzanite, tourmaline and combinations thereof.

86. A method of hard tissue modification comprising:

filling the porous layer of the hard tissue with a fluidified material preheated above at least its fluidity temperature; and

letting the fluidified material cool and solidify in the porous layer.

87. The method of Claim 86, wherein the fluidified material is glass, crystal or ceramic and mixture thereof.

88. A method of hard tissue modification comprising:

impregnating a porous surface of the hard tissue with particles having a fluidity temperature higher than a melting temperature of a hard tissue of the porous surface; and

filling the porous surface with a material preheated above its fluidity temperature, wherein the fluidity temperature of the material is lower than a melting temperature of the particles and that of the hard tissue.

89. The method of Claim 88, wherein the material is glass, crystal or ceramió or mixture thereof.

90. The method according to any of the Claims 53, 62, 68, 75, 80, 86, or 88, wherein the porous layer is a carious lesion, open dentine, cementum, bone, cartilage or nail.

91. The method according to any of the Claims 53, 62, 68, 75, 80, 86, or 88, wherein the porous layer is formed by applying the compound comprised of an acid.

92. The method according to any of the Claims 53, 62, 68, 75, 80, 86, or 88, wherein selectively heating the porous layer is followed by active control cooling.

93. The method according to Claim 92, wherein active control cooling is provided by water.

94. A method of hard tissue modification comprising forming a post-treatment layer having a composition differing from that of the hard tissue by selectively heating a porous layer on the hard tissue.

95. The method of Claim 94, comprising a step of forming the porous layer by applying to the hard tissue a composition having an acid before selectively heating the porous layer.

96. The method of Claim 94, comprising a step of impregnating the porous layer with particles before selectively heating the porous layer.

97. The method of claim 17, wherein the composition comprises peroxide in of concentration up to 35%.

98. A method for tooth rejuvenation comprising:

applying to a tooth a layer of a composition comprising an aqueous solution of one or more edible acids, wherein the composition has a pH selected from the range of about 0.5 to 5 and wherein the composition contains up to 35% of peroxide; and

removing the composition from the tooth.

99. The apparatus of Claim 49, further comprising a valve coupling the first portion and the second portion to the chamber.

100. The method according to Claim 22, wherein the step of applying the composition and the step of applying the remineralization compound alternate.

101. A method comprising:

applying to a tooth a layer of a first composition comprising an aqueous solution of one or more edible acids, wherein the first composition has a pH selected from the range of about 0.5 to 5;

selectively heating the layer to a temperature selected from the range from about 37°C to 60°C for a time period from about 1 second to about 60 minutes;

applying to the tooth a second composition comprising bleaching compound; and

removing the second and the first compositions from the tooth.

102. The method of Claim 101 where bleaching compound comprises peroxide with concentration of up to 35%.

103. The method of Claim 101, further comprising applying to the tooth a remineralization compound.

104. An apparatus comprising:

a hand piece having a distal end and a proximal end and a channel extending between the distal and proximal ends;

a heater coupled to the hand piece or detached from the hand piece, wherein the heater is so located that it generates enough heat to fluidify a material passing through the channel when the apparatus is in operation; and

a mechanism for transporting the material through the channel from the distal end to the proximal end.

105. The apparatus of Claim 104, wherein the material is a fiber.

106. The apparatus of Claim 104, wherein the material comprises solid-state particles.

107. The apparatus of Claim 104, wherein the heater is a light heater, an electric heater, a microwave heater, an acoustic heater, a high-frequency electric heater, an inductor heater, and a gas heater and combinations thereof.

108. The apparatus of Claim 104, wherein the material is glass, crystal or ceramic and mixture thereof.

109. The apparatus of Claim 104, wherein the material is selected from the group of inorganic glass or organic glass.

110. An apparatus comprising:

a probe having a distal end, a tip and a reservoir for containing a mixture, the mixture comprising a water-based acid solution and solid-state particles;

a first heater coupled to the probe and serving to heat the mixture when the apparatus is in operation; and

a device associated the tip and serving to generate enough heat to melt a hard tissue disposed in proximity to the tip when the apparatus is in operation.

111. The apparatus as in Claim 110, wherein the device associated with the tip is a second heater.

112. The apparatus of Claim 110, wherein the device associated with the tip is a scanner connected to laser source via an optical pathway.

113. The apparatus of Claim 110, wherein the hard tissue is a tooth.

114. The method according to Claim 22, wherein the step of applying the composition and the step of applying the remineralization compound alternate.

115. The tooth rejuvenating composition of Claim 27 further comprising Ca, Cr, Ba, Cd, Mg, P, As, Si, F.

116. The method of Claim 27, wherein one or more edible acids is selected from the group consisting of acetic acid, citric acid, tartaric acid, lactic acid, fumaric acid, malic acid, maleic acid, ascorbic acid, adipic acid, sorbic acid and combinations thereof.

117. The tooth rejuvenating article of manufacture of Claim 32, further comprising Ca, Cr, Ba, Cd, Mg, P, As, Si, and F.

118. The applicator of Claim 39, wherein the pH is selected from the range of about 0.5 to about 3.